State of California
AIR RESOURCES BOARD

Research Screening Committee Meeting
Cal/EPA Headquarters Building
1001 I Street
Conference Room 510
Sacramento, California 95814
(916) 445-0753

March 8, 2013
9:00 a.m.

ADVANCE AGENDA

I. Approval of Minutes of Previous Meeting:

October 26, 2012 meeting

ll. Discussion of Draft Final Reports:

1) "Cardiopulmonary Health Effects: Toxicity of Semi-Volatile and Non-Volatile Components of Ultrafine Particulate Matter," University of California, Irvine, $501,484, Contract No. 07-307

The objective of this project was to determine the relative contributions of the semi volatile and non-volatile fractions of ultrafine particles (UFP) to health outcomes. Epidemiological and animal studies have shown associations between exposure to near-roadway particulate matter (PM) and adverse health impacts, including cardiovascular morbidity and mortality and pro-inflammatory effects. However, little is known about the role of the semi-volatile constituents of PM in generating these negative outcomes. Therefore, the current project studied the cardiopulmonary effects of exposure to UFP, with and without semi-volatile components, in an atherosclerotic mouse model. Results of this study showed that exposure to UFP's semi-volatile constituents accelerated the development of atherosclerotic plaque and decreased heart rate variability in mice. These findings provide evidence that the semi-volatile constituents of ambient PM may be causally related to cardiopulmonary health effects. These results also suggest that emission control measures that remove organic constituents of combustion-generated aerosols could benefit public health because coronary artery disease is a leading contributor to heart-related deaths in California.

2) "Personal, Indoor, and Outdoor Particulate Air Pollution and Heart Rate Variability in Elderly Subjects with Coronary Artery Disease," University of California, Irvine, 235,000, Contract No. 08-307

This study evaluated the relationships of heart rate variability (HRV) and cardiac arrhythmias to particulate matter (PM) exposures. Decreased HRV is a marker of

autonomic dysfunction and has been associated with future cardiac morbidity and mortality. However, HRV has been inconsistently associated with exposure to PM air pollution. Furthermore, few studies have examined whether air pollution exposure is a risk factor for cardiac arrhythmias. Results from this study support the hypothesis that exposure to PM and ozone increases the risk of one specific type of cardiac arrhythmia, ventricular tachycardia, among elderly subjects with coronary artery disease. The present findings enhance our current understanding of the health impacts associated with exposure to the air pollutant components of traffic emissions. The relationship between pollution exposure and normal cardiac function are a major concern in California, especially near roadways; thus, efforts to decrease traffic emissions are likely to have an impact on adverse cardiovascular events, including arrhythmias that have been linked to sudden cardiac death.

3) "Characterization of the Atmospheric Chemistry in the Southern San Joaquin Valley," University of California, Berkeley, $1,095,000, Contract No. 08-316

Concentrations of ozone (O_3) and PM2.5 in the San Joaquin Valley (SJV) continue to frequently exceed ambient air quality standards. In fact, the southern Valley experiences the worst air quality in the nation. Air quality progress has occurred more slowly in the Valley than in the more populated South Coast Air Basin (SoCAB) despite relatively similar control efforts. The objectives of this project were to coordinate measurements with the large CalNex 2010 field study (research in California at the nexus of air quality and climate change) to investigate the atmospheric chemistry occurring within the SJV. The investigators made a wide range of gaseous and some aerosol (primarily nitrate) measurements at a monitoring site just southeast of the Bakersfield urban area. The investigators found that NO_X controls are important for improving air quality in the SJV. Although the NO_X reductions have been marginally effective in the past in reducing peak ozone concentrations, the changing balance of ozone precursors in the Valley indicated that NO_X reductions are poised to cause substantial reductions in ozone concentrations. In addition, the investigators found that NO_X emissions contribute to the aerosol problem via the production of organic nitrate aerosols and that continued NO_X reductions will also improve PM2.5 air quality. The project results also indicated that diesel emissions are a major contributor to secondary organic aerosols (SOA) at this location. This extensive research project confirmed ARB's strategy of aggressively reducing emissions of both NO_X and volatile organic compounds.

4) "Characterization of Ambient Aerosol Sources and Processes During CalNex 2010 with Aerosol Mass Spectrometry," University of Colorado, $285,000, Contract No. 08-319

Fine particle air pollution is a persistent problem in many urban areas of California, with organic species often dominating the submicron portion. The sources and processing of this organic aerosol (OA), however, are highly uncertain. This project carried out a detailed characterization of submicron organic aerosols in the Los Angeles area during the 2010 California Research at the Nexus of Air Quality and Climate Change (CalNex 2010) field campaign. A suite of instruments, including high-resolution aerosol mass spectrometry (HR-AMS) and co-located gaseous and particle instruments at the Pasadena site, were utilized to determine sources, composition and atmospheric processing of aerosols. Five OA components were identified using HR-AMS data and organic tracers; secondary organic aerosol (SOA)

accounted for the majority of OA mass with smaller contributions from primary combustion emissions and cooking-influenced particulate matter (PM). The ratio of the production rates of SOA to odd oxygen (O_X) was similar to those from other urban studies, which indicates a similar formation chemistry that is independent of location. Lack of a weekend-weekday (WE/WD) effect in SOA formation suggests that gasoline vehicles were the dominant contributor to SOA, under the assumption that most SOA precursors are from motor vehicles. The results from this work have several possible regulatory implications; e.g., a significant portion of PM2.5 mass is composed of SOA, the precursors of which are not adequately regulated.

5) "Hourly In-Situ Quantitation of Organic Aerosol Marker Compounds During CalNex 2010," University of California, Berkeley, $249,999, Contract No. 09-316

Many urban and rural air quality districts are out of compliance with California and federal ambient air quality standards for particulate matter less than 2.5 microns in diameter (PM2.5). While many advances have been made in measuring and modeling the inorganic ionic species that are found in PM, much less is known about the organic fraction. Yet organic matter can be a major constituent of aerosols. Quantitative, time-resolved knowledge of the composition of organic aerosols is critical to identifying its sources, to understanding its formation and transformation processes, and to evaluating its roles in PM air quality and in global climate change. This project used thermal desorption aerosol gas chromatography/mass spectrometry (TAG) to better characterize the composition of ambient aerosols less than 1 micron in diameter (PM1). These data were analyzed by Positive Matrix Factorization (PMF) to characterize the nature and sources of the PM1. The results indicate that the PM1 in the southern San Joaquin Valley (SJV) is a mixture of primary and secondary aerosols associated with mobile sources, natural and agricultural biogenic sources, sources associated with the oil and gas industry, and upwind sources via transport. The on-going reduction in emissions from motor vehicles should continue to reduce not only primary emissions but also the formation of secondary aerosols. This project helped to refine the relative roles of biogenic emissions and ammonia in aerosol formation in the southern SJV.

6) "A Field Experiment to Assess the Impact of Information Provision on Household Electricity Consumption," University of California, Los Angeles, $173,934, Contract No. 08-325

Household energy consumers face a complex non-linear pricing tariff and many households are unaware of how energy management actions affect their electricity consumption. This project examined the impact of providing current information on a household's electricity consuming actions on how that household responds to a nonlinear retail price schedule for electricity. Over 2,000 households, from two different utilities, participated in a customized on-line interactive educational program that taught them how their monthly electricity bill was determined from a nonlinear retail pricing scheme they face. Households were shown how changes in their major electricity-consuming activities would affect their monthly bill under the nonlinear pricing scheme. Using data from before and after this intervention for households that took the educational program and a randomly selected set of control households who did not take the treatment, the researchers assessed the impact of the information intervention on a household's monthly electricity consumption. For both utilities,

households that learned they faced a high marginal price for consuming electricity reduced their electricity consumption relative to the control group. Households that learned they faced a low marginal price increased their electricity consumption relative to the control group. These results suggest that an intervention that targets educating households with customized information can help them become more sophisticated energy consumers and in aggregate help California to achieve its Assembly Bill (AB) 32 goals of reducing greenhouse gas emissions.

7) "Identifying Determinants of Very Low Energy Consumption Rates Observed in Some California Households," University of California, Davis, $104,911, Contract No. 09-326

Strategies for pursuing California's ambitious greenhouse gas (GHG) policies generally focus on technology upgrades familiar from the energy efficiency sector, but very little attention is paid to the social dynamics surrounding energy consumption. Observed residential electricity usage falls within a wide range of values, even for populations living in the same climate. This study investigated the circumstances corresponding to electricity consumption levels in a sample of urban California households in the lowest decile of energy use. Primary data were generated through mailed surveys, telephone interviews, and a detailed customer dataset supplied by the partnering electric utility. The survey focused on appliance ownership and use, building characteristics, demographics, attitudes about energy, energy-relevant behaviors, participation in incentive programs, and air conditioning. This study found that very low consumption rates are real and that the distribution of low usage includes a broad cross section of the population quite similar to the general population (as measured by age, income, education, race, and household size). Thermal management strategies ranked high among the behavior trends of the lowest energy users. The researchers found a diversity of cooling strategies, tolerance for and definition of what is too hot. The researchers also generated several user profile types that capture different dimensions of the low user population this research and identified key characteristics that combine low usage, diverse cooling strategies, an interest in energy upgrades, and high quality of life in multiple different ways.

8) "Black Carbon and the Regional Climate of California," University of California, San Diego, $820,483, Contract No. 08-323

Black carbon (BC) is the most strongly light-absorbing component of particulate matter (PM), and is formed by the incomplete combustion of fossil fuels, bio-fuels, and biomass. BC has been tied to regional climate change by its contribution to global warming and the suppression of precipitation. Unlike other greenhouse gases (GHG), BC has a short atmospheric lifetime resulting in a strong correlation to regional emission sources. This report provides an assessment of the impact of BC on the regional radiative forcing and climate trends of California. This regional integrated assessment is the first such attempt to estimate the radiative forcing of BC for California, both from a bottom-up approach (starting with the emission inventory as input to aerosol-transport models) and a top-down approach (utilizing satellite data in conjunction with ground-based column-averaged aerosol optical properties). This balanced approach enabled the investigators to uncover three unanticipated major findings. The first finding concerns the large decadal trends in decreasing BC concentrations that have occurred largely in response to policies enacted to decrease PM emissions from diesel combustion. The second is the discovery of the large effect

of brown carbon (a form of organic carbon aerosols) on radiative forcing. And the third is the large discrepancy between the top-down and the bottom-up approaches of estimating radiative forcing. It was speculated that the discrepancy is due to a combination of emission inventory bias and neglect of organic carbon (OC) absorption in the model. The results of this research project provide valuable insights regarding the role of BC aerosols on California's climate.

lll. Discussion of Responses to Requests for Proposals (RFP):

1) "Technical Analysis of Vehicle Load-Reduction Potential for Advanced Clean Cars," $250,000, RFP No. 12-311

lV. Other Business:

1) Update on a research proposal titled, "Investigating Controls and Measurement Methods of Semi-Volatile Organic Compound Emissions from Light-Duty Vehicles"

2) Update on RFP 12-310 titled, "Evaluating Technologies and Methods to Lower Nitrogen Oxide Emissions from Heavy-Duty Vehicles"

3) Resolution for Dan Costa